IMPACT OF FARM INPUTS ON COTTON PRODUCTION IN PAKISTAN (1980-2013)

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Abstract

The aim of the paper is to examine the area under cotton cultivation, fertilizers off-take and credit disbursement and its impact on productivity of cotton in Pakistan during1980 to 2013. The findings showed that one hectare increase in the area under cotton cultivation leads to 0.98 tones increase in total cotton production while 1 percent increase in fertilizer off-take because cotton brings about 0.33 tones increase in cotton production while 1 percent increase in credit disbursement for agriculture sector brings about 0.000829 tones increase in cotton production. Due to positive , statistically significant relationship at 5 percent and high value of R-squared (0.82) of the two explanatory variables(area under cotton cultivation and fertilizers off-take for cotton) so it is recommended that more and more area under cotton cultivation should be brought, suitable and proper amount of fertilizers off-take should be managed to increase cotton production. Credit disbursement is insignificant but with positive sign shows that government should provide farmers with credit facility, so that they may be able to raise the yield of cotton production. BT cotton varieties should be locally developed and distributed among the farmers in order to increase cotton yield.

Keywords: impact, farm inputs, area, fertilizer off-take, cotton productivity, econometric analysis, credit disbursement

Introduction

Cotton is the major cash crop of Pakistan which is also called "White Gold". It brings cash returns to farmers, supplies raw materials to the Textile Industries and provides employment to the people both in rural and urban areas. Pakistan is the fourth largest cotton producer country and number third consumer of cotton in the world. Since 1980 to 2013 significant fluctuations in cotton production and its area under cultivation took place. In 1980 – 1981 the total area under cotton cultivation was 2108 thousand hectares which has increases to 3106 thousand hectares in 20012 – 2013. In 1981 the total cotton production was 715 thousand tones which has increase to 2196 thousand tones in 2009 – 2010 (Statistical Supplement 2012 – 2013). On the other hand fertilizer off-take for cotton was 172 nutrient tones which was increased to 348.80 nutrient tones in 2009 – 2010 (NFDC). Credit disbursement for agriculture sector was4019.59(000,hectares) which increased to 248120.48(000,hectares) in 2012-2013 in Pakistan There are also

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other inputs of cotton production in Pakistan but area under cotton cultivation and fertilizer off-take are key inputs through which its production can be increased.

If we look at cotton crop, it is a soft fluffy staple fiber that grows in a shape of ball or protective capsules around the seed of cotton plants of the genus Gossypium.

The history of cotton can be traced back to domestication possibly as far back as 4500 BC. Cotton played an important role in the history of British Empire, the US, India and some other countries of the world.

Herodotus, an ancient Greek historian mentioned Indian cotton in the fifth century BC as "a wool exceeding in beauty and goodness that of sheep".

In the eighth century the Muslim conquests of Spain expanded the European cotton trade and by the end of fifteen century Venice, Antwerp and Haarlem were important ports for cotton trade and the sale and transportation of cotton fabrics had become a very profitable business. Cotton belt is a term applied to a region of the Southern United States, here cotton was the predominant cash crop since eighteen century to the twentieth century. Cotton is an important crop in Pakistan. It can be easily liquidated in money and is one of the expensive crops. In Pakistan it is mostly cultivated in plain areas of Punjab and Sind. It contributes 8.2 percent to the agriculture income and 3.2 percent in the national income of Pakistan. By increasing the production of cotton we can also enhance the export of other such industrial goods that are dependent on cotton.

Pakistan s cotton is favored in the whole world due to its low price and high quality. Even India buys cotton from Pakistan due to its low price and high quality. There are two major insect pest that damage the cotton crop which includes sucking and chewing. Sucking pest can be controlled by different pesticides and chewing pest is now being controlled by BT cotton available by different research and development institutes throughout the country. Different institutes provide different types of BT cotton that are least attractive for chewing pest.

The production of BT cotton is higher as compared to other types of cotton, so this crop may increase the domestic income and productivity of cotton.

In Pakistan cotton yield are stagnant for most of the time since 1980 due to excessive rains at the time of sowing, high temperature at the time of flowering, leaf curl virus, soil erosion, adverse weather, pest attack, improper production, illiterate farmers, high cost of inputs, fragmentation of land, orthodox behavior of the farmers, lack of guidance to farmers and high cost of production. In the recent past two major factors had significant impact on economic of cotton production, one of them is the extensive use of agro chemicals and the second one is yield stagnation among agro chemicals fertilizers and insecticides. There are no efficient alternatives to synthetic fertilizers and cotton production depends on nutrient supplements in the form of inorganic fertilizers. Insects being living organisms have adjusted to live & survive with insecticide so as a result insecticides use is kept on increasing which causes a serious impact on cotton production. Currently there is serious need of more and more research and development in this area but most researchers are reluctant to maintain the current status of their

countries. The cost of production of cotton has not been increased not only in Pakistan but internationally which can be a serious threat to cotton production.

Agronomics practices can also effect the production of cotton in Pakistan which includes sowing time, low quality of seeds, timing of harvest, irrigation, soil fertility, and tillage and cultivators selection. In economic term Pakistan has suffered a loss of Rs. 71 billion in cotton production since 1980 due to CLCUV (cotton leaf curl virus) disease only. All these problems have to be solved by the government by adopting appropriate policies.

Literature review

Numbers of studies have been conducted on this topic some of which are given below:-

Khan et.al, (1986) observed that high cost of inputs, scarcity of financial resources, lack of access to markets and untrained farmers are responsible for low production of cotton.

Hine et.al, (2012) examined the economic impact of BT cotton varieties on farmers wellbeing. The result indicated that the impact of BT cotton on wellbeing of farmers in Pakistan however varies by agro climatic conditions and farm sizes.

Anwar, (1998) concluded that if cost of cultivation, fertilizers, irrigation, Inter culturing, hoeing, labor, plant protection, seeds & sowing are to be minimized and managed in efficient ways than overall cost of production would decrease and net income of the farmers would increase due to increase in overall production.

Anwar et.al, (2009) applied Cobb Douglas production function to various inputs to see their effect on cotton yield. The results depicted that cost benefit ratio was 1.41 for large,1.24 for medium and1.22 for small farmers so that inputs should be provided by both public and private sectors to increase cotton production.

Carlos et.al, (2002) introduced yield and acreage model for Pakistan, India and Australia. The result depicted was that cotton production depends on prices of cotton, competing crops, fertilizers, area under cotton cultivation and time trend.

Hina et.al, (2004) concluded that inputs involved in cotton production are cost intensive. The cost of land is high (Land Rent) while cost of seeds are lower and with the passage of time cost of production of cotton has increased which resulted in overall negative returns during 2002, 2006 and 2007.

Hassan, (1991) concluded that costly inputs, scarce financial support, untrained farmers and no access to markets are main causes for the low yield per hectares and eventually less benefits to the farmers.

KhudaBaksh et.al, (2005) used Cobb Douglas production function and revealed that high skilled farmers to prepare barren land for cultivation, high quality of seeds and protection of plants were contributing towards high cotton yield and among these variables plant protection measures had a positive effect on yield and was significant with 0.224 coefficient.

Muhammad Abid et.al, (2011) also used Cobb Douglas production function to observe the effect of different agronomic and demographic variables on BT Cotton Productivity and found that focusing on maintenance and improving the quality of soil is necessary to get high yields.

Nabi Muhammad, (1991) concluded that use of inputs variables has direct relationship with production and profit of farmers.

Sab. E. ET. Al, (2009) concluded that among the cost of inputs variables the highest cost was of labor.

Pakistan cotton yield remained sluggish up to 1960, Afterwards when green revolution was introduced and chemical fertilizers and new cotton varieties were introduced, and then the yield started to increase. During 1983-1984 heavy rains badly damaged the crops and the country had to import cotton during 1986 and up to1992 the rate of textile mills installation increased at an increasing rate. The increasing trend of inputs use coupled with partial crop mechanization increased per hectare cost of production. It has been confirmed by various field studies that although the appropriate use of inputs has resulted in increased yield but the farmers profit share gradually reduced. The cotton support price, prices of inputs and weather play crucial role in the cotton production process. The production process involves different inputs. Every input has its influence and play a vital role in the process. The basic input was increase in area under cultivation on crop condition. The other inputs include fertilizer, seeds, water irrigation and plant protection measure etc. all these inputs also play crucial role in cotton production.

Hazoor et.al, (2011) in his article attempted to quantify the impact of BT cotton on existing cropping pattern and found that BT cotton area was increasing first at the expense of wheat area and then secondly on sugarcane area out of total 300 sample farmers 70% wheat growers' and 28% sugarcane growers' showed their interest to shift some area from their respective crops to BT cotton. Thus, there were the chances that textile sector will groom but in future it will create food insecurity problem.

KhudaBuksh, (2011) in his working paper estimated the benefits from adopting BT cotton seed in Punjab in 2008 and 2009 by using reduced form panel models to determine the average effect of BT cotton technology on short run profits yields and farm inputs on average.

The econometric estimation shows that BT adopting farmers receive 10% high yield per hectare, reduce per hectare pesticides used by some 22%, and increase per hectare use of irrigation water by 8% as a result of conversion of 78% of cropped area into BT cotton.

M. Abid et.al, in their article determined the impact of soil quality on BT cotton productivity by using Cobb-Douglas production function to assess the effect of various agronomic and demographic variables on the BT cotton productivity. Result indicated that land preparation cost, seed cost, fertilizer cost, labor cost and dummy variables and soil quality were significant and positively contributed towards higher BT cotton yield. While spray cost and irrigation cost variables were found positive but insignificant.

Finding of the study suggested that focusing on maintaining and improving the quality of soil is necessary to obtain higher crop yield.

The current paper is different from the previous ones as it applies econometric techniques to show the impact of area under cotton cultivation, fertilizer off-take and credit disbursement on its productivity in Pakistan using time series data.

Materials and methods

The current paper has been conducted in 2014 by using econometric model during the time period of thirty years.

Time Series Data from1980 – 2013 on the above four inputs, area under cotton cultivation, fertilizers take off for cotton and credit disbursement for agriculture sector has been used. The data has been collected from economic survey of Pakistan (Statistical Supplement 2012 - 2013). Augmented Dickey Fuller (ADF) test is used to check the stationary of the dependent and independent variables of data. The Schwarz Info Criterion is used to select the stationary of data; Variables which were non-stationary at level form have been made stationary after taking their first difference. Moreover Johnsons Co-Integration test is also used to analyze long term relationship among the variables of the series.

To show the impact of area under cotton cultivation, fertilizers off-take for cotton and credit disbursement for agriculture sector (Independent Variables) on total cotton productivity (dependent variable) the models of ordinary least square is used.

$$TCP = \beta 1 + \beta 2AUC + \beta 3FOC + \beta 4CD$$

Where:

TCP = Total cotton production (000, tones) in Pakistan.

AUC = Area under cotton crop (000, hectares) in Pakistan.

FOC = Fertilizers off-take for cotton (000, nutrient tones) in Pakistan.

CD= Credit Disbursement in Pakistan for agriculture sector.

Results and discussions

Regression results of 4 variables (areas under cotton cultivation, fertilizers off take for cotton and credit disbursement for agriculture sector on dependent variable (total cotton production) are given below. The table shows that 1 hectare increase in area under cotton cultivation brings 0.98 tones increase in total cotton production and one percent increase in fertilizer off-take for cotton increases cotton production by 0.33 tones and 1 percent increase in credit disbursement for agriculture sector bring 0.000829 tones increase in cotton production. Three of the independent variables Area under cotton cultivation, Fertilizers off take for cotton and Credit disbursement for agriculture sector have positive sign showing positive relationship with dependent variable i.e. total cotton production. Also coefficients of both independent variables Area under cotton

cultivation and Fertilizers off take for cotton are statistically significance at 5 percent level of significance and their T- values are also greater than 2 while the third variable Credit disbursement is statistically insignificant because its T-value is 0.54 which is less than 2. Value of R-squared is (0.82) and adjusted R-Squared is (0.80) both are high which shows that his model is best fitted. It means most of the independent variables are explaining 82 percent of the variations in the dependent variable (Total cotton production).

Dependent Variable: TCP

Method: Least Squares

Date: 01/16/14 Time: 13:59

Sample: 1981 2010

Included observations: 30

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1368.916	647.5263	-2.114070	0.0443
AUC	0.989203	0.314420	3.146120	0.0041
FOC	0.330026	0.617504	2.101720	0.0597
CD	0.000829	0.001530	0.541806	0.5926

R-squared	0.826717	Mean dependent var	1577.267
Adjusted R-squared	0.806723	S.D. dependent var	481.8105
S.E. of regression	211.8199	Akaike info criterion	13.67292
		Schwarz criterion	13.85974
Log likelihood	-201.0937	F-statistic	41.34782
Durbin-Watson stat	1.534888	Prob(F-statistic)	0.000000

As Durbin-Watson Stats is (1.53) which is near to 2 so it shows there is no auto co-relation in this regression. Also the value of R-Squared is high (0.82) while values of 2 individuals parameters (area under cotton cultivation and fertilizers off take for cotton) are significant at 5 percent so it shows no multi co-linearity while applying the white test with cross terms also shows that the value of F-Statistics is in significant (1.234) which is less than 2 so there is no hetroscadisty in this series.

The ADF test has been presented in table No.2. In table 2 the Stationarity of data is been checked by taking both intercept and trend. Variables which were not stationary at level form have been made stationary after taking their first difference shown by I(1) and then second difference I(2) if it is needed. .

Table 2 ADF Test result for Stationarity (Including intercept and trend)

Variables	I(0) (Level Form)		I(1) (First Difference)		Results
	Test Statistic	Probabilities	Test Statistic	Probabilities	
TCP	- 3.4781 [0]	0.060	-5.828 [2]	0.0003	I(1)
AUC	-3.026 [0]	0.142	- 4.0448 [6]	0.0224	I(1)
FOC	-2.337 [0]	0.4019	-5.470 [3]	0.0009	I(1)
CD	2.075 [0]	1.00	-2.692	0.0247	I(1)

values in square brackets along each statistics represent lag, length using the Schwarz info criterion using 7 as maximum lag.

Moreover there is a possibility of spurious regression results so the Johnsons co-integration test is used, the trace statistic values are given in Table 3 (Including both intercept and trend) which indicates the long term relationship among the taken variables and rejects the hypothesis of no co-integration because one of the absolute values of the trace statistic 65.213 is greater than its relevant critical value 63.876.

Table 3 Johnsons Co-Integration test results including intercept and trend

	Trace statistics	5 Percent	Prob**	Hypothesized
Eigenvalue		Critical Value		No. of CE(s)
0.6456	65.213	63.876	0.0384	None*
0.438	36.164	42.915	0.2003	At most 1
0.347	20.018	25.812	0.225	At most 2
0.250	8.079	12.517	0.2453	At most 3

*(**) denotes rejection of the hypothesis at 5% Significance Level.

Conclusions and recommendations

Due to the above discussion it is absolutely clear that cotton production is mostly dependent upon its area under cultivation and fertilizers off-take in Pakistan.

1 hectares increase in area under cotton cultivation brings about 0.98 tones increase in total cotton production while 1 percent increase in fertilizer off-take for cotton leads to increase cotton production by 0.33 tones and 1 percent increase in credit disbursement for agriculture sector brings 0.000829 tones increase in cotton production. Both the explanatory variables Area under cotton cultivation and Fertilizers off take for cotton are statistically significant at 5 percent level, have positive sign while third variable Credit disbursement have positive sign but is statistically insignificant. Its value is less than five percent.

Government should make efforts to bring more and more area under cotton cultivation, appropriate and suitable selling and distribution of fertilizer for cotton crop must be ensured. Still there is increasing pressure under consumption of cotton production so appropriate agriculture input policy is needed in this sector. Credit should be given to farmers so that they can purchase good quality inputs to increase cotton production.

In the present age the cotton crop is not very much beneficial to the farmers due to expensive pesticide fertilizers and high fuel prices. So government must control, guide and appreciate research and development institutes so that they can produce new type of cotton that are easy to grow with high production level which helps in country development.

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